

SCIENCE

NEW YORK, FEBRUARY 6, 1891.

THE STUDY OF INDIAN LANGUAGES.

As the number of those interested in the study of Indian languages increases, the need of a complete classification of Indian languages and dialects becomes more and more apparent. The investigations necessary to such a classification were begun many years ago by the Bureau of Ethnology, and from time to time field investigations have been conducted with especial reference to it. Sufficient progress has been made to permit the publication of a classification of all Indian languages in the territory north of Mexico, together with a map displaying the area occupied by the several families.

The classification is primarily based upon an examination of the linguistic material relating to the subject. Mr. James C. Pilling has been engaged in the preparation of the bibliography of this literature, and several volumes of the bibliography have already been published. The literature itself is classified by him as far as possible in compliance with this scheme. Secondarily the classification is based on a large body of linguistic material now in the archives of the bureau, which also received notice in Mr. Pilling's "Bibliography."

Mr. H. W. Henshaw is engaged on the tribal synonymy, and a large volume on this subject is approaching completion. The tribal synonymy is also based upon this classification. The classification itself is the work of the Director of the bureau.

It will of course be understood that such a classification must be purely tentative, and that it will require modification as new material is acquired by students, and as present views in regard to the relationship of existing families may be changed by further study. All the material relating to the classification will appear in the seventh annual report of the bureau, now in the hands of the printer.

The subject is deemed of sufficient interest and importance to warrant the present publication of the principles upon which the classification has been based, and of the rules which have guided in the selection of family names, together with a list of the families.

The languages spoken by the pre-Columbian tribes of North America were many and diverse. Into the regions occupied by these tribes, travellers, traders, and missionaries have penetrated in advance of civilization, and civilization itself has marched across the continent at a rapid rate. Under these conditions, the languages of the various tribes have received much study. Many extensive works have been published, embracing grammars and dictionaries; but a far greater number of minor vocabularies have been collected, and very many have been published. In addition to these, the Bible, in whole or in part, and various religious books and school-books, have been translated into Indian tongues, to be used for purposes of instruction, and newspapers have been published in the Indian languages. Altogether the literature in these languages, together with the literature relating to it, is of vast extent. While the

materials seem thus to be abundant, the student of Indian languages finds the subject to be one of great magnitude, difficulties arising from the following conditions:—

1. A great number of linguistic stocks or families is discovered.

2. The boundaries between the different stocks of languages are not immediately apparent, from the fact that many tribes of diverse stocks have had more or less association, and to some extent linguistic materials have been borrowed, and thus have passed out of the exclusive possession of cognate peoples.

3. Where many peoples, each few in number, are thrown together, an intertribal language is developed. To a large extent this is gesture speech; but to a limited extent useful and important words are adopted by various tribes, and out of this material an intertribal "jargon" is established. Travellers and all others, who do not thoroughly study a language, are far more likely to acquire this jargon speech than the real speech of the people; and the tendency to base relationship upon such jargons has led to confusion.

4. This tendency to the establishment of an intertribal jargon was greatly accelerated on the advent of the white man, for thereby many tribes were pushed from their ancestral homes, and tribes were mixed with tribes. As a result, new relations and new industries, especially of trade, were established, and the new associations of tribe with tribe and of the Indians with Europeans led very often to the development of quite elaborate jargon languages. All of these have a tendency to complicate the study of the Indian tongues by comparative methods.

The difficulties inherent in the study of languages, together with the imperfect material and the complicating conditions that have arisen by the spread of civilization over the country, combine to make the problem one not readily resolved.

In view of the amount of material on hand, the comparative study of the languages of North America has been strangely neglected, though perhaps this is explained by reason of the difficulties which have been pointed out. And the attempts which have been made to classify them has given rise to much confusion, for the following reasons: first, later authors have not properly recognized the work of earlier laborers in the field; second, the attempt has more frequently been made to establish an ethnic classification than a linguistic classification, and linguistic characteristics have been confused with biotic peculiarities, arts, habits, customs, and other human activities, so that often radical differences of language have been ignored, and slight differences have been held to be of primary value.

The attempts at a classification of these languages and also at a classification of races have led to the development of a complex, mixed, and inconsistent synonymy, which must first be unravelled and a selection of standard names made therefrom, according to fixed principles.

It is manifest that until proper rules are recognized by scholars the establishment of a determinate nomenclature is impossible. It will therefore be well to set forth the rules that have here been adopted, together with brief reasons for

the same, with the hope that they will commend themselves to the judgment of other persons engaged in researches relating to the languages of North America.

A fixed nomenclature in biology has been found not only to be advantageous, but to be a prerequisite to progress in research, as the vast multiplicity of facts, still ever accumulating, would otherwise overwhelm the scholar. In philological classification, fixity of nomenclature is of corresponding importance; and while the analogies between linguistic and biotic classification are quite limited, many of the principles of nomenclature which biologists have adopted having no application in philology, still, in some important particulars the requirements of all scientific classifications are alike, and, though many of the nomenclatural points met with in biology will not occur in philology, some of them do occur, and may be governed by the same rules.

Perhaps an ideal nomenclature in biology may sometimes be established, as attempts have been made to establish such a system in chemistry; and perhaps such an ideal system may eventually be established in philology. Be that as it may, the time has not yet come even for its suggestion. What is now needed are rules of some kind leading scholars to use the same terms for the same things; and it would seem to matter little in the case of linguistic stocks what the nomenclature is, provided it becomes denotive and universal.

In treating of the languages of North America, it has been suggested that the names adopted should be the names by which the people recognize themselves; but this is a rule of impossible application, for, where the branches of a stock diverge very greatly, no common name for the people can be found. Again, it has been suggested that names which are to go permanently into science should be simple and euphonic. This also is of impossible application, for simplicity and euphony are largely questions of personal taste; and he who has studied many languages loses speedily his idiosyncrasies of likes and dislikes, and learns that words foreign to his vocabulary are not necessarily barbaric.

Biologists have decided that he who first distinctly characterizes and names a species or other group shall thereby cause the name thus used to become permanently affixed, but under certain conditions adapted to a growing science which is continually revising its classification. This law of priority may well be adopted by philologists.

By the application of the law of priority it will occasionally happen that a name must be taken which is not wholly unobjectionable, or which could be much improved; but, if names may be modified for any reason, the extent of change that may be wrought in this manner is unlimited, and such modifications would ultimately become equivalent to the introduction of new names, and a fixed nomenclature would thereby be overthrown. The rule of priority has therefore been adopted.

Permanent biologic nomenclature dates from the time of Linnæus, simply because this great naturalist established the binominal system and placed scientific classification upon a sound and enduring basis. As Linnæus is to be regarded as the founder of biologic classification, so Gallatin may be considered the founder of systematic philology relating to the North American Indians. Before his time much linguistic work had been accomplished; and scholars owe a lasting debt of gratitude to Barton, Adelung, Pickering, and others. But Gallatin's work marks an era in American linguistic science from the fact that he so thoroughly introduced comparative methods, and because he circumscribed the boundaries of many families, so that a large part of his

work remains and is still to be considered sound. There is no safe resting-place anterior to Gallatin, because no scholar prior to his time had properly adopted comparative methods of research, and because no scholar was privileged to work with so large a body of material. It must further be said of Gallatin that he had a very clear conception of the task he was performing, and brought to it both learning and wisdom. Gallatin's work has therefore been taken as the starting-point, back of which we may not go in the historic consideration of the systematic philology of North America. The point of departure, therefore, is the year 1836, when Gallatin's "Synopsis of Indian Tribes" appeared in Vol. II. of the "Transactions of the American Antiquarian Society."

It is believed that a name should be simply a denotive word, and that no advantage can accrue from a descriptive or connotive title. It is therefore desirable to have the names as simple as possible, consistent with other and more important considerations. For this reason it has been found impracticable to recognize as family names designations based on several distinct terms, such as descriptive phrases, and words compounded from two or more geographic names. Such phrases and compound words have been rejected.

There are many linguistic families in North America, and in a number of them there are many tribes speaking diverse languages. It is important, therefore, that some form should be given to the family name by which it may be distinguished from the name of a single tribe or language. In many cases some one language within a stock has been taken as the type, and its name given to the entire family; so that the name of a language and that of the stock to which it belongs are the same. This is inconvenient, and leads to confusion. For such reasons it has been decided to give each family name the termination "an" or "ian."

Conforming to the principles thus enunciated, the following rules have been formulated:—

1. The law of priority relating to the nomenclature of the systematic philology of the North American tribes shall not extend to authors whose works are of date anterior to the year 1836.
2. The name originally given by the founder of a linguistic group to designate it as a family or stock of languages shall be permanently retained to the exclusion of all others.
3. No family name shall be recognized if composed of more than one word.
4. A family name, once established, shall not be cancelled in any subsequent division of the group, but shall be retained in a restricted sense for one of its constituent portions.
5. Family names shall be distinguished as such by the termination "an" or "ian."
6. No name shall be accepted for a linguistic family unless used to designate a tribe or group of tribes as a linguistic stock.
7. No family name shall be accepted unless there is given the habitat of the tribe or tribes to which it is applied.
8. The original orthography of a name shall be rigidly preserved, except as provided for in Rule 3, and unless a typographical error is evident.

The terms "family" and "stock" are here applied interchangeably to a group of languages that are supposed to be cognate.

A single language is called a stock or family when it is not found to be cognate with any other language. Languages are said to be cognate when such relations between

them are found that they are supposed to have descended from a common ancestral speech.

The evidence of cognation is derived exclusively from the vocabulary. Grammatical similarities are not supposed to furnish evidence of cognation, but to be phenomena, in part relating to stage of culture, and in part adventitious. It must be remembered that extreme peculiarities of grammar, like the vocalic mutations of the Hebrew or the monosyllabic separation of the Chinese, have not been discovered among Indian tongues. It therefore becomes necessary, in the classification of Indian languages into families, to neglect grammatical structure, and to consider lexical elements only. But this statement must be clearly understood. It is postulated that in the growth of languages new words are formed by combination, and that these new words change by attrition to secure economy of utterance, and also by assimilation (analogy) for economy of thought. In the comparison of languages for the purposes of systematic philology it often becomes necessary to dismember compounded words for the purpose of comparing the more primitive forms thus obtained. The paradigmatic words considered in grammatical treatises may often be the very words which should be dissected to discover in their elements primary affinities; but the comparison is still lexic, not grammatical.

A lexic comparison is between vocal elements: a grammatical comparison is between grammatical methods, such, for example, as gender systems. The classes into which things are relegated by distinction of gender may be animate and inanimate, and the animate may subsequently be divided into male and female, and these two classes may ultimately absorb, in part at least, inanimate things. The growth of a system of genders may take another course. The animate and inanimate may be subdivided into the standing; the sitting, and the lying, or into the moving, the erect, and the reclined; or, still further, the superposed classification may be based upon the supposed constitution of things, as the fleshy, the woody, the rocky, the earthy, the watery. Thus the number of genders may increase, while farther on in the history of a language the genders may decrease so as almost to disappear. All of these characteristics are in part adventitious; but to a large extent the gender is a phenomenon of growth, indicating the stage to which the language has attained. A proper case system may not have been established in a language by the fixing of case particles, or, having been established, it may change by the increase or diminution of the number of cases. A tense system also has a beginning, a growth, and a decadence. A mode system is variable in the various stages of the history of a language. In like manner a pronominal system undergoes changes. Particles may be prefixed, infixes, or affixed in compounded words, and which one of these methods will finally prevail can be determined only in the later stage of growth. All of these things are held to belong to the grammar of a language, and to be grammatical methods distinct from lexical elements.

With terms thus defined, languages are supposed to be cognate when fundamental similarities are discovered in their lexical elements. When the members of a family of languages are to be classed in subdivisions and the history of such languages investigated, grammatical characteristics become of primary importance. The words of a language change by the methods described, but the fundamental elements or roots are more enduring. Grammatical methods also change, perhaps even more rapidly than words; and the changes may go on to such an extent that primitive methods are entirely lost, there being no radical grammatical

elements to be preserved. Grammatical structure is but a phase or accident of growth, and not a primordial element of language. The roots of a language are its most permanent characteristics; and while the words which are formed from them may change so as to obscure their elements, or in some cases even to lose them, it seems that they are never lost from all, but can be recovered in large part. The grammatical structure or plan of a language is forever changing, and in this respect the language may become entirely transformed.

Below is a list of the fifty-eight families, alphabetically arranged, with a general statement of the habitat of each. Most of the names contained in the list need no explanation, as they are familiar to linguistic students, having appeared years ago in the writings of Gallatin, Latham, Prichard, Scouler, Turner, and others. Several of the names are new. Thus, the name "Chumashan" is applied to the group of languages hitherto generally known under the term "Santa Barbara," and includes the dialects formerly spoken at the several missions along the Santa Barbara Channel, California, and is derived from the name of the Santa Rosa Island tribe. This language is now spoken by a score or more of Indians.

The Esselenian family applies to the language of a tribe, possibly a small group of tribes, on and south of Monterey Bay. Until recently the language has been supposed to belong to the Moquelumnan family, but is now believed to represent a distinct group. The family name is derived from the name of the Esselen tribe. The language is now practically extinct, but a short vocabulary was collected by Mr. Henshaw in 1888.

The Yanan family includes one language only, that of the tribe called by Powers, Gatschet, and others, "Nozi" or "Noces." The word means "people" in their own language.

List of Families.

- Adaizan.—On Red River, Texas.
- Algonquian.—Of the North Atlantic seaboard, and west through the Northern States, Lake region, and Canada, to the Rocky Mountains.
- Athapascan.—Of the interior of British America; isolated communities on the Columbia River, Oregon, California, Arizona, and New Mexico.
- Attacapan.—Area on Texas coast.
- Beothukan.—Portion of Newfoundland.
- Caddoan.—Of northern Nebraska, western Arkansas, southern Indian Territory, western Louisiana, and northern Texas.
- Chimakuan.—Of part of the southern shore of Puget Sound.
- Chimarikan.—On New and Trinity Rivers, northern California.
- Chimmesyan.—The region of Nasse and Skeena Rivers, west coast British Columbia.
- Chinookan.—Banks of the Columbia River as far up as the Dalles.
- Chitimachan.—About Lake Barataria, southern Louisiana.
- Chumashan.—Coast of California from about the 34th parallel to a little north of the 35th.
- Coahuiltecan.—Of south-western Texas and north-eastern Mexico.
- Copehan.—West of the Sacramento as far north as Mount Shasta, California.
- Costanoan.—Coast of California from the Golden Gate south to Monterey Bay.
- Eskimauan.—East and west coasts of Greenland; coast of Labrador as far south as Hamilton Inlet; and the Arc-

tic coast westward, including part of the shore of Hudson Bay, to western Alaska, including the Aleutian Islands.

Esselenian.—Coast of California from Monterey Bay to Santa Lucia Mountain.

Iroquoian.—The St. Lawrence River region north of Lake Erie, northern Pennsylvania, State of New York, the lower Susquehanna in Pennsylvania and Maryland, north-eastern North Carolina, south-western West Virginia, western North Carolina, and most of Kentucky and Tennessee.

Kalapooian.—Valley of the Willamette River, Oregon.

Karankawan.—Texas coast around Matagorda Bay.

Keresan.—Upper Rio Grande, and on the Jemez and San José Rivers, New Mexico.

Kiowan.—Upper Arkansas and Purgatory Rivers, Colorado.

Kitunahan.—Cootenay River region, mostly in British Columbia.

Koluschan.—North-west coast from 55° to 60° north latitude.

Kulanapan.—Russian River region, and California coast from Bodega Head north to about latitude 39° 30'.

Kusan.—Coast of middle Oregon, Coos Bay and River, and at mouth of Coquille River, Oregon.

Lutuamian.—Region of Klamath Lakes and Sprague River, Oregon.

Mariposan.—Interior of California, east of the Coast Range, and south of Tulare Lake, in a narrow strip to below Tulare Lake, north as far as the Fresno River.

Moquelumnian.—Interior of California, bounded on the north by the Cosumnes River, on the south by the Fresno, on the east by the Sierras, and on the west by the San Joaquin; an area north of San Francisco and San Pablo Bays as far as Bodega Head and the head waters of Russian River.

Muskogean.—The Gulf States from the Savannah River and the Atlantic west to the Mississippi, and from the Gulf to the Tennessee River.

Natchesan.—On St. Catherine Creek, near the site of the present city of Natches.

Palaihnihan.—Drainage of Pit River in north-eastern California.

Piman.—On the Gila River about 160 miles from its mouth, and on the San Pedro, in Arizona, and in Mexico on the Gulf of California.

Pujunan.—California; east bank of the Sacramento about 100 miles from its mouth, north to Pit River, eastward nearly to the borders of the State.

Quoratean.—Lower Klamath River, Oregon, from Happy Camp to the junction of the Trinity and Salmon River valley.

Salinan.—Region around the San Antonio and San Miguel missions, California.

Salishan.—North-western part of Washington, including Puget Sound, eastern Vancouver Island to about midway its length; coast of British Columbia to Bute Inlet; and the region of Bentinck Arm and Dean Inlet.

Sastean.—Middle Klamath River, northern California.

Shahaptian.—Upper Columbia River, and its tributaries in northern Oregon and Idaho and southern Washington.

Shoshonean.—Occupying generally the Great Interior Basin of the United States, as far east as the Plains, and reaching the Pacific in Los Angeles, San Bernardino, and San Diego Counties, California.

Siouan.—The Dakotas, parts of Minnesota, Wisconsin, Iowa, Nebraska, Kansas, Missouri, Arkansas, Indian Territory, with isolated colonies in Alabama (Biloxi), the Carolinas (Catawba), and borders of Virginia and North Carolina (Tutelo).

Skittagetan.—Queen Charlotte Islands, Forrester Island, and south-eastern part of Prince of Wales Island.

Takilman.—Oregon coast about the lower Rogue River.

Tañoan.—Rio Grande and tributary valleys, from about 30° to about 36° 30'.

Timuquanan.—Florida.

Tonikan.—Lower Yazoo River, Mississippi.

Tonkawan.—Western and south-western parts of Texas.

Uchean.—Lower Savannah River and perhaps the South Carolina coast.

Wailatpuan.—Lower Walla Walla River, Oregon, and about Mounts Hood and Jefferson.

Wakashan.—West coast of Vancouver Island, and north-west tip of Washington.

Washoan.—Eastern base of the Sierras, south of Reno, Nevada, to the lower end of Carson valley.

Weitspekan.—Lower Klamath River, Oregon, from the mouth of the Trinity.

Wishoskan.—Coast of California from just below the mouth of Eel River to a little north of Mad River.

Yakonan.—Along the lower Yaquina, Alsea, Siuslaw, and Umpqua Rivers, Oregon.

Yanan.—Chiefly in the southern part of Shasta County, California.

Yukian.—Round valley, California, and west to the coast.

Yuman.—Lower California; the Colorado from its mouth to Cataract Creek, the Gila and tributaries as far east as the Tonto Basin, Arizona.

Zuñian.—A small area on Zuñi River, western New Mexico.

J. W. POWELL.

NOTES AND NEWS.

THE director of the central dispensary at Bagdad has sent to *La Nature* a specimen of an edible substance which fell during an abundant shower in the neighborhood of Merdin and Diarbékir (Turkey in Asia) in August, 1890. The rain which accompanied the substance fell over a surface of about ten kilometres in circumference. The inhabitants collected the "manna," and made it into bread, which is said to have been very good, and to have been easily digested. The specimen sent to *La Nature* is composed of small spherules, according to *Nature* of Jan. 15. Yellowish on the outside, it is white within. Botanists who have examined it say that it belongs to the family of lichens known as *Lecanora esculenta*. According to Decaisne, this lichen, which has been found in Algeria, is most frequently met with on the most arid mountains of Tartary, where it lies among pebbles from which it can be distinguished only by experienced observers. It is also found in the desert of the Kirghizes. The traveller Parrot brought to Europe specimens of a quantity which had fallen in several districts of Persia at the beginning of 1828. He was assured that the ground was covered with the substance to the height of two decimetres, that animals ate it eagerly, and that it was collected by the people.

—Mr. William Warren supplies some information to *Engineering* regarding his work in the search for seams of coal in Tonquin, which, as the result of the late wars there, is now part of the French territory. The coal, of which there is an extensive field, will add greatly to the importance of the territorial acquisition to the French in view of its importance as a coaling station, and will afford a further evidence of the varying fortunes of politicians, as M. Ferry, rising from the obloquy into which he fell as a result of the public disapproval of the continuance of the campaign, will now find favor and commendation for foresight. The seams of

coal have been known for something like half a century. They crop out all round the bases of lowish hills which fringe the shores of the Gulf of Tonquin. One of the seams is 152 feet thick, of almost solid coal. It is a semi-anthracite of very fine quality, having about 87 per cent of fixed carbon, and from 7 to 12½ per cent of volatile matter, from 2 to 3 per cent ash, free from pyrites, and of course quite smokeless. A steamer named "Fatsan," of fourteen knots speed, has been tried with 300 tons of the coal. The results were very satisfactory, the vessel steaming well at a fully maintained speed, with almost the same consumption as in the case of Cardiff coal. The discovery is a serious one for the Japanese coal industry, as Hong-Kong formerly took about 50,000 tons monthly. The Japan coal has 23 to 27 per cent of ash, against 2 to 3 per cent in the Tonquin coal. The gain in decreased consumption is enhanced by reason of the increased cargo space available, or, in other cases, in allowing the vessels to keep the sea for a longer time.

—The lion is eaten by some African races, but its flesh is held in small esteem. The Zulus find carrion so much to their liking, that, according to the late Bishop Colenso, they apply to food peopled by large colonies of larvæ the expressive word "uborni," signifying in their uncouth jargon "great happiness." David Livingstone, that keen and accurate observer, reminds us that the aboriginal Australians and Hottentots prefer the intestines of animals. "It is curious," he says, "that this is the part which animals always begin with, and it is the first choice of our men." On this point it may be well to remind the civilized reader that the woodcock and the red mullet, or sea woodcock, are both eaten and relished without undergoing all the cleaning processes which most animals used for food among us generally experience to fit them for the table; so that our aversion to the entrails of animals is not absolute, but only one of degree. The hippopotamus is a favorite dish with some Africans when they can get this unwieldy and formidable river monster, and when young its flesh is good and palatable, but with advancing years it becomes coarse and unpleasant. The Abyssinians, the amiable people to whom, according to the Italian prime minister, his countrymen proposed to teach wisdom and humanity, find the rhinoceros to their taste: so they do the elephant, which is also eaten in Sumatra. Dr. Livingstone describes the elephant's foot as delicious, and his praises will be echoed by many travellers in lands where that sagacious monster still lingers in rapidly decreasing numbers. "We had the foot," wrote the doctor, "cooked for breakfast next morning, and found it delicious. It is a whitish mass, slightly gelatinous, and sweet like marrow. A long march to prevent biliousness is a wise precaution after a meal of elephant's foot. Elephant's tongue and trunk are also good, and, after long simmering, much resemble the hump of a buffalo and the tongue of an ox; but all the other meat is tough, and, from its peculiar flavor, only to be eaten by a hungry man."

—The London *Times* for Jan. 19 contains some interesting information about the manuscript of Aristotle recently discovered in Egypt, and now in the British Museum. It is described as a constitutional history of Athens, and as one of a collection of constitutions which Aristotle accumulated, describing various ancient states, and numbering 158. The treatise in its present form contains 63 chapters of the size of those in Thucydides; but the first chapter is missing, and a few at the end mutilated. It is written on three papyrus rolls, and on what is called the *verso*, or back, side; the *recto* being occupied with the record of the bailiff's receipts and expenditures on a private estate in Egypt, dated month by month in the eleventh year of Vespasian, about A.D. 79. This record, which shows some of the peculiarities of writing found in the treatise itself, tends strongly to confirm the genuineness of the manuscript, which is further proved by the fact, that, of 91 passages in ancient writers known or believed to be quoted from this work, 78 are in this manuscript, and the others may reasonably be referred to those parts that are lost. Of the 63 chapters, 41 relate the constitutional changes in the Athenian state from the time of Cylon in 632 B.C., to the restoration of the democracy in B.C. 403, while the remaining chapters describe the duties of the various magistrates. It is said that the work will

not alter our general views of Greek history, but supplies many new details, and fixes many dates that were heretofore uncertain. One of the most important items thus revealed to us is the fact that Themistocles took a leading part in the overthrow of the Areopagus, he being a member of that body at the time. The text of the work has been printed, and will shortly be published, with introduction and notes by F. G. Kenyon, an assistant at the museum in the department of manuscripts; and it will also be issued in facsimile. The finding of this work, together with some discoveries of less importance previously made in Egypt, give ground for hope that other classical works, including some of the lost lyric and dramatic poetry, may yet be recovered.

—Capt. de Place of Paris has invented an instrument for detecting flaws in metal castings and forgings, which is called the "sciséophone." According to the London *Times*, the apparatus consists of a small pneumatic tapper worked by the hand, and with which the piece of steel or iron to be tested is tapped all over. Connected with the tapper is a telephone with a microphone interposed in the circuit. Two operators are required, — one to apply the tapper, and the other to listen through the telephone to the sounds produced. These operators are in separate apartments, so that the direct sounds of the taps may not disturb the listener, whose province it is to detect flaws. The two, however, are in electrical communication, so that the instant the listener hears a false sound he can signal to his colleague to mark the metal at the point of the last tap. In practice the listener sits with the telephone to his ear, and so long as the taps are normal he does nothing. Directly a false sound (which is very distinct from the normal sound) is heard, he at once signals for the spot to be marked. By this means he is able not only to detect a flaw, but to localize it. Under the auspices of the South eastern Railway Company, a demonstration of the sciséophone was given by Capt. de Place, at the Charing Cross Hotel, in the presence of several members of the Ordnance Committee and other government officials. Mr. Stirling, the company's locomotive superintendent, had previously had several samples of steel, wrought iron, and cast iron prepared with hidden flaws known only to himself. The first sample tested by Capt. de Place he pronounced to be bad metal throughout, which Mr. Stirling stated he knew it to be. Other samples were tested, and the flaws localized by means of the apparatus. On some of the bars of wrought and cast iron being broken, the internal flaws, the localities of which were known to Mr. Stirling by his private mark, were found to have been correctly localized by Capt. de Place. On the other hand, some bars were broken at points where the apparatus indicated a flaw, but where the metal proved to be perfectly sound; so that the apparatus is not yet quite trustworthy.

—Dr. William Crookes delivered his presidential address before the Institution of Electrical Engineers, London, on Thursday, Jan. 15, taking as his subject "Electricity in transitu: from *Plenum* to *Vacuum*." In his introductory remarks, as we learn from *Nature*, he explained that he was about to treat electricity, not so much as an end in itself, but rather as a tool, by whose judicious use we may gain some addition to our scanty knowledge of the atoms and molecules of matter, and of the forms of energy which by their mutual re-actions constitute the universe as it is manifest to our five senses. Explaining what he meant in characterizing electricity as a tool, he said, that, when working as a chemist in the laboratory, he found the induction spark often of great service in discriminating one element from another, also in indicating the presence of hitherto unknown elements in other bodies in quantity far too minute to be recognizable by any other means. In this way chemists have discovered thallium, gallium, germanium, and numerous other elements. On the other hand, in the examination of electrical re-actions in high *vacua*, various rare chemical elements become in turn tests for recognizing the intensity and character of electric energy. Electricity, positive and negative, effect respectively different movements and luminosities: hence the behavior of the substances upon which electricity acts may indicate with which of these two kinds we have to deal. In other physical researches both electricity and chemistry come into play simply as means of exploration.

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Attention is called to the "Wants" column. All are invited to use it in soliciting information or seeking new positions. The name and address of applicants should be given in full, so that answers will go direct to them. The "Exchange" column is likewise open.

HEREDITARY DEAFNESS. — A STUDY.

THE American Asylum is the oldest school for deaf-mutes in the United States. Its history covers three-quarters of a century. It has had under instruction, including those now in school, 2,459 pupils, a number exceeded by that of but one other school in this country. There have been nearly six hundred marriages, in which one or both of those making the marriage contract were once pupils in the school, and the offspring of these marriages number over eight hundred children. The records of the school have been carefully preserved, and from these and much personal inquiry we have been able to gather some facts which will be interesting at this time, when the question of hereditary deafness is receiving so much public attention. It will be seen at a glance that the field is a favorable one for the study of this subject, and, though not broad enough to warrant the drawing of general conclusions therefrom, the facts are valuable pointers, and may serve as one of the studies, which, when collated, will give sufficient data to work out a general law.

That there is a tendency to deafness in the offspring of congenitally deaf parents, there can be no doubt. Nor can it be doubted that this tendency is comparatively slight in the offspring of parents both of whom are adventitiously deaf. But let the facts speak for themselves. They are believed to be reliable so far as they go; but it is quite probable that in some of the families included in the following table other children may have been born since the dates at which the facts were reported. The general proportion, however, in all probability, would not be affected by such additions. In this table, c. = congenitally deaf; ad. = adventitiously deaf; h. = hearing; u. = age at which deafness occurred unknown.

When we consider how heavy a handicap congenital deafness is, it is appalling to think that 31 per cent of the offspring of the congenitally deaf may be born deaf. But I believe that this proportion is far above that of the general

average of such cases throughout the country. I believe that there are causes at work in New England, not in operation to any thing like the same extent in other parts of the country, which will account for no inconsiderable part of the large percentage of congenital deafness in the offspring of congenitally deaf parents in that section.

Facts gathered from the Records of the American Asylum at Hartford, Conn.

	Number of Marriages.	Children Congenitally Deaf.	Children Adventitiously Deaf.	Hearing Children.	Children whether Deaf or Hearing unknown.	Whole Number of Children.	Percentage of Children Congenitally Deaf.
Husband, c.; wife, c....	52	48		88	15	151	31.78
Husband, c.; wife, ad..	37	5	1	74	7	87	5.74
Husband, ad.; wife, c..	51	17		102	5	124	13.70
Husband, ad.; wife, ad..	55	4		129	6	139	3.87
Husband, h.; wife, c....	16	12		52	2	66	18.18
Husband, h.; wife, ad..	5			16	2	18	
Husband, h.; wife, u....	1			4		4	
Husband, c.; wife, h....	26	9		58	5	72	12.50
Husband, ad.; wife, h..	6			13		13	
Husband, ad.; wife, u....	23			43	8	51	
Husband, u.; wife, u....	2			4	2	6	
Husband, c.; wife, u....	27	9		58	4	71	12.67
Husband, u.; wife, h....	1			4		4	
Husband, u.; wife, c....	2			4	1	5	
	31						
Sterile.....	283						
Totals.....	590	104	1	649	57	811	12.82

¹ Three families are reported with several hearing children in each.

Of the fifty-two families in which both parents are congenitally deaf, twenty-three have congenitally deaf children.

Of the thirty-seven families in which the husbands are congenitally deaf and the wives adventitiously deaf, two have deaf children,—four in one family, and one in the other.

Of the fifty-one families in which the fathers were adventitiously deaf and the mothers congenitally deaf, seven produced deaf children, and nine of the congenitally deaf children come from two families.

There are fifty-five families in which both parents are adventitiously deaf, and from these have sprung four congenitally deaf children,—one in each of four families.

Four of the sixteen families in which the husbands hear and the wives are congenitally deaf have deaf children.

In five families out of the twenty-six in which the husbands are congenitally deaf and the wives hear, there are children born deaf.

Six of the twenty-seven families in which the husbands were congenitally deaf and the state of the hearing of the wives is unknown produced congenitally deaf children.

Of the twenty-six families in which both parents are deaf and have congenitally deaf children, there are five families in which one of the parents has one deaf parent, seventeen families in which both parents have deaf relatives of the same generation, four in which one parent has deaf relatives

of the same generation, and five in which neither parent has deaf relatives of the same generation.

Of the twenty-six families in which both parents are congenitally deaf and have hearing children only, there is none in which either parent has a deaf parent, so far as reported, twelve families in which both parents have deaf relatives of the same generation, eleven families in which one parent has deaf relatives of the same generation, and three families in which neither parent has deaf relatives of the same generation.

It will be noticed in the table given above that nearly one-half of the marriages are without issue, so far as we have been able to learn. It is probable that in some cases there have been children of whom we have received no account. In other cases the marriages are of recent date. But making due allowance for all these, the proportion of sterile marriages is still very large, much exceeding that in the general population. It is a serious question whether nature alone is responsible for this barrenness.

JOB WILLIAMS.

THE RELATION BETWEEN SCIENTIFIC AND ECONOMIC ENTOMOLOGY.¹

THE subject of this address is not of the kind usually chosen for similar occasions, but is of none the less interest and importance. It is one, also, that is in full harmony with the genius of this society, which is the recognition of the pre-eminence of what is called the philosophy of science. Another reason makes it of especial immediate importance to us. Economic entomology is upon the verge of an era of great advancement. The establishment of the agricultural experiment stations have added to its ranks more young men of scientific training and ability, perhaps, than have ever engaged in this line of investigation. If economic entomology is but a phase of scientific entomology, then we want to put forth special efforts to assimilate this young blood in our ranks: if, on the other hand, they are different and distinct, the difference will become more and more apparent as economic entomology develops, and we should define our position as on the side of pure science.

I believe that the pure sciences are distinct from the economic sciences; that this is the primary division of science. We seem to be prone, in this utilitarian age, to try to find excuse for the pursuit of pure science by holding up the possibility of applying our discoveries for economic ends. Let us recognize, and not act as though we were ashamed of, the fact that the sole aim of the student of pure science is the discovery of truth, catering to human wants being entirely out of his province.

It may be said, that, laying aside this matter of sentiment, the human wants are supplied through the discoveries of science, and that this is simply the application of science for economic purposes, or, to put it a little stronger, that economics are but applied sciences. Such a statement comes from the conception that facts are, or in some way become, the peculiar property of a science. This is not the case, however. Perhaps, if we could see all the intimate relations sciences have to each other, we should say that every fact belongs to every science; at any rate, we could scarcely name a fact which when closely viewed has not more than one bearing. An example of the far-reaching character of a fact is that of the origin of species through evolution. When Darwin es-

tablished the truth of this fact, it soon came to be recognized that this basal fact of evolution was a fundamental principle of almost every other science which had occupied the attention of man. For economic purposes it is the facts which are appropriated, and in the same way that the biologist appropriates the facts discovered by the chemist. Economic sciences no more become departments or applications of other sciences by using some of the same facts than biology becomes a department or application of chemistry.

It may be further contended that in the cases cited above we have to do with real sciences, but that the so-called economic sciences have no right to the title of science, that they are essentially different. This will lead us to a consideration of what a science is. We have just seen that it does not consist of a body of facts peculiar to itself; but, on the other hand, it is evident that facts are closely connected with it, that it depends indeed on a set of facts, and, further, that these facts have some definite relation to each other and are susceptible of a rational classification. This classification is not the science, as it cannot express nearly all the relationships, but these relationships do constitute the science. Any one science does not comprehend all the bearings of any fact, but only such as have a relation to that one subject. The science of entomology, for example, consists of the relationship of the facts to insects. The relation of the same facts to the subject of plant-diseases belongs to another science. When the subject is economic, the production of honey, the feeding of stock, or the like, are there any grounds upon which we can refuse it the title of science?

The economic sciences are all infantile, many perhaps not yet even conceived of by man. They are the only true foundation to the useful arts. Agriculture is a science, though hidden by a mass of misconception and empiricism. It must make its advances by the same methods that have made the pure sciences what they are. A clear conception of the object and structure of the science and experimentation with all the conditions under control are essential. Economic entomology as generally understood is chiefly a department of agriculture, but includes much heterogeneous material. To be a scientifically rational term, it must, like some of the genera of the older naturalists, be restricted. I can in no better way show the difference between it and scientific entomology than to indicate the parts of economic entomology, and show where they belong among the economic sciences.

Insects of economic importance may be grouped into six categories: first, those directly injurious to man, which properly forms a department of medicine; second, those attacking the domestic animals, a part of veterinary medicine; third, those injuring cultivated plants, which includes by far the major part of the injurious insects, and to which the term "economic entomology" should be restricted (it is only a part, and perhaps not a natural part, of the science which deals with the diseases of cultivated plants); fourth, those which destroy other property (in this category are the insects attacking furs, woollen goods, etc., and the food-stuffs, which belong to domestic economy and at the same time to commerce; library insects belong to library economy, and so on); fifth, those directly beneficial to man, which includes the bee, the silk-worm, etc.,—industries which form one of the primary divisions of agriculture; sixth, those indirectly beneficial to man by destroying the injurious insects (these insects, of course, belong to the sciences that consider the insects which are their victims).

Finally, to recapitulate, scientific entomology is a depart-

¹ Annual address of the retiring president of the Cambridge Entomological Club, Charles W. Woodworth, Fayetteville, Ark., at its meeting, Jan. 9, 1891 (from *Psyche*).

ment of biology; economic entomology, of agriculture. They have all the difference between them that there is between a pure science and an economic science. Can we as a society include them both? I think we should not. On the other hand, the economic entomologists are nearly all at the same time scientific entomologists. These we can and do welcome.

AFRICAN AND AMERICAN.

At a meeting of the Canadian Institute, Toronto, Jan. 24, Mr. D. R. Keys, M.A., read, on behalf of Mr. A. F. Chamberlain, M.A., fellow in Clark University, Worcester, Mass., a valuable and interesting paper entitled "African and American: the Contact of the Negro and the Indian." He said that the history of the negro on the continent of America has been studied from various points of view, but in every case with regard to his contact with the white race. It must therefore be a new as well as an interesting inquiry, when we endeavor to find out what has been the effect of the contact of the foreign African with the native American stocks. Such an investigation must extend its lines of research into questions of physiology, psychology, philology, sociology, and mythology.

The writer took up the history of the African negro in America in connection with the various Indian tribes with whom he has come into contact. He referred to the baseless theories of pre-Columbian negro races in America, citing several of these in illustration. He then took up the question ethnographically, beginning with Canada. The chief contact between African and American in Canada appears to have taken place on one of the Iroquois reservations near Brantford. A few instances have been noticed elsewhere in the various provinces, but they do not appear to have been very numerous. In New England, especially in Massachusetts, considerable miscegenation appears to have taken place, and in some instances it would appear that the Indians were bettered by the admixture of negro blood which they received. The law which held that children of Indian women were born free appears to have favored the taking of Indian wives by negroes.

On Long Island the Montauk and Shinnecock Indians have a large infusion of African blood, dating from the times of slavery in the Northern States. The discovery made by Dr. Brinton, that certain words (numerals) stated by the missionary Pyrlaeus to be Nanticoke Indian were really African (probably obtained from some runaway slave or half-breed), was referred to. In Virginia some little contact of the two races has occurred, and some of the free negroes on the eastern shore of the Chesapeake peninsula show evident traces of Indian blood. The State of Florida was for a long time the home of the Seminoles, who, like the Cherokees, held negroes in slavery. One of their chiefs was said, in 1835, to have had no fewer than one hundred negroes. Here considerable miscegenation has taken place, although the authorities on the subject seem to differ considerably on questions of fact. In the Indian Territory, to which Cherokees, Seminoles, and other Indian tribes of the Atlantic region have been removed, further contact has occurred, and the study of the relations of the Indian and negro in the Indian Territory, when viewed from a sociological standpoint, are of great interest to the student of history and ethnography. The negro is regarded in a different light by different tribes of American aborigines. After mentioning a few isolated instances of contact in other parts of the United States, the writer proceeded to discuss the relations of African and Indian mythology, coming to about the same conclusion as Professor T. Crane, that the Indian has probably borrowed more from the negro than has the negro from the Indian. The paper concluded with calling the attention of the members of the institute to the necessity of obtaining with all possible speed information regarding (1) the results of the intermarriage of Indian and negro, the physiology of the offspring of such unions; (2) the social status of the negro among the various Indian tribes, the Indian as a slaveholder; (3) the influence of Indian upon negro and of negro upon Indian mythology.

DEPOPULATION OF FRANCE.¹

It is somewhat startling to find that the depopulation of France is becoming a common subject of discussion among the *savants* of that country. The phrase is perhaps somewhat stronger than the circumstances of the case warrant, the fact being that the population of France is simply stationary. Still it is a striking and significant circumstance, that, while the population of all the other great European nations is steadily and rapidly advancing, that of France remains at a standstill. On economic grounds, this arrest of increase in number might seem not altogether an unmixed evil, inasmuch as it should tend to diminish over-competition, and to ease the already excessive struggle for existence among the lower classes; but an impression widely prevails, that, given a fairly normal and healthy social condition, a growth of population is a natural result, and that a stationary or declining population is an index of some grave disorder of the body politic. We cannot adequately discuss this large and difficult question, but our French neighbors evidently think that something is amiss, and are looking around for the cause and for its remedy. Probably the causes are numerous and complex. Social habits may account for a good deal. The French custom of subdividing land and of providing a dowry for girls offers an obvious motive for keeping down the number of children. Where, as in the west of Ireland, the peasantry have a cheap food-supply, and are constitutionally averse to thrift, large families are the rule; but in France thrift is a virtue carried almost to excess, and the obligation of the parents to provide for each new accession to the family is clearly recognized. Moral causes have been supposed to play a large part in the arrest of the population of France, and we are far from underestimating their importance; but this is a difficult and delicate problem, on which it would be rash to dogmatize without the most ample evidence.

While some of the causes of the phenomenon under discussion may be obscure and remote, others lie under our eyes, and cannot be too carefully scrutinized or too frankly acknowledged. In a recent address before the Académie de Médecine, Dr. Brouardel drew attention to the abnormal mortality from small-pox and typhoid-fever which prevails in France. He points out that while Germany loses only 110 persons per annum from small-pox, France actually loses 14,000. Dr. Brouardel attributes this astounding difference to the rigid way in which vaccination is enforced in Germany, and to the carelessness of his own countrymen in this matter. Statistics show that in 1865, when vaccination was not obligatory in Prussia, the mortality was 27 per 100,000 inhabitants. After vaccination was enforced, the mortality fell in 1874 to 3.60 per 100,000, and in 1886 to 0.049. At the present time the mortality from this cause in France is 43 per 100,000. We make a present of these figures of Dr. Brouardel to the Royal Commission on Vaccination.

As regards typhoid-fever, the deaths due to this disease in France amount to 23,000 per annum. Dr. Brouardel gives a great variety of statistics to show that the liability to typhoid is in direct proportion to the imperfections in the water-supply, and that, in proportion as a sufficient supply of pure water is provided, typhoid abates. Thus, at Vienne the typhoid mortality was 200 per 100,000 while the inhabitants drank surface, hence often polluted, water; but this mortality fell to 10 per 100,000 on a thoroughly good supply being obtained. At Angoulême the introduction of a new supply of pure water reduced the number of cases of typhoid in the proportion of 0.063 to 18. At Amiens, among the military population, the typhoid mortality fell from 111 per 10,000 to 7 when a pure supply of water was secured by artesian wells. At Rennes the inhabitants formerly drank from contaminated wells, with the result that typhoid-fever was always endemic. The introduction of pure water reduced the deaths from typhoid among the military population from 43 per 10,000 to 2. Investigations carried out at Besançon, Tours, Carcassonne, Paris, and Bordeaux entirely corroborate the above striking figures. Typhoid-fever is responsible for the death of 1 soldier in 335 in France, or 298 per 100,000, and this in time of peace. In war its ravages are even far greater. Thus the expeditionary

¹ From the London Lancet, Dec. 20, 1890.

corps to Tunis in 1881, consisting of 20,000 men, had 4,500 cases of typhoid, with 884 deaths.

Dr. Brouardel concludes by affirming that if vaccination and re-vaccination were rendered obligatory in France, and if the towns were everywhere supplied with pure water, the country would save from 25,000 to 30,000 lives annually, and these, for the most part, of young persons of marriageable age. He therefore proposes to the academy to adopt the following conclusions: "that the sanitary law in preparation ought to render vaccination obligatory; it ought to furnish sufficient authority to the municipalities, or in their default the prefect or the government, to secure the public health against the dangers which result from using polluted water."

In the discussion which followed Dr. Brouardel's communication many important points were elicited. One speaker drew attention to the evils which arose from cheap lodging-houses. Another insisted upon the superiority of supplying pure water to any methods of filtration. At Angoulême filtration was tried with some advantage, but the provision of a pure supply proved much more successful.

We may learn something from the anxieties of our neighbors. If the outcry against compulsory vaccination now prevailing in some quarters in this country should unhappily effect any slackening in our vigilance in this matter, we shall surely pay the penalty in a heavier mortality from one of the most loathsome of diseases. The example of Germany in this matter is admirable, and cannot be too widely known or too carefully followed. The provision of an absolutely pure supply of water to our large cities is a much more difficult problem than the thorough enforcement of vaccination, but it is at least the ideal towards which our efforts must be directed. It is an immense gain to know positively both the source of danger and the means of averting it, and we must never rest content so long as an acknowledged source of disease, misery, and national weakness is permitted to exist in our midst.

MEAT-PRESERVATION.

DR. HANS BEU points out that nearly all the newer methods of preparing preserved meats have had to give way before the older methods of boiling, drying, salting, and smoking, which, along with freezing, preserve the taste and digestibility of meats better than any of the chemical methods that have more recently been recommended. As stated in the *British Medical Journal*, all these old methods hinder decomposition, and keep meats eatable for a longer or shorter period. Cold acts by preventing putrefactive changes in meat, 2° to 4° C., with good ventilation, preventing the development of most organisms. Boiling, with subsequent exclusion of air, is, of course, good, but can only be carried out in large establishments and under specially favorable conditions. Drying gets rid of the water, without which micro-organisms cannot develop; but, although there is no loss of albuminoid or salts when this method is used, the taste is somewhat impaired. Salt also acts by removing water, but it also removes the extractives, and interferes with the delicate flavor of both meat and fish. Smoke acts partly by drying, the heat at which it is generated rendering this necessary, but partly, also, by the action of the small quantities of the antifermentative constituents, such as creosote, carbolic acid, and even volatile oils, which appear to have a direct action on the vitality of putrefactive organisms.

The author agrees with Förster, that salt has little or no effect upon most pathogenic organisms, but it undoubtedly interferes with the development of the cholera bacillus and of anthrax bacillus that contains no spores, and probably, also, of some of the non-pathogenic but putrefactive forms.

As the result of his experiments on a very large number of food-materials, such as ham, bacon, pork, various kinds of sausages, and fish, Beu comes to the conclusion that most meats are salted not only to preserve the taste, but also to withdraw a large proportion of the water from flesh; that smoking also withdraws a considerable quantity of water, that it hides the salty taste, and that, being able to penetrate dried flesh, it is better able to exert its antiputrefactive action than on fresh meat. Salted lean flesh, exposed to the action of smoke at from 22° to 25° C. for forty-

eight hours, no longer contained liquefying organisms, which had been present in considerable numbers before the smoking operation was commenced, but non-liquefying organisms disappeared only on the ninth day of smoking. Salt bacon salted for ten days, and then exposed to the action of smoke for forty-eight hours, also showed no liquefying organisms with a fragment from near the centre taken with the most strict precautions, and broken up in liquid gelatine, which was afterwards allowed to solidify. All non-liquefying organisms had disappeared on the seventh day of smoking. Bacon salted for five weeks contained no organisms after seven days' smoking. Fresh unsalted meat contained both kinds after six days of smoking, and sausage also contained both at the end of twelve days; this being exactly in accordance with what would be expected from the large amount of water that it contained, from the nature of the meat used, and from the many manipulative processes through which it has to go before the smoking is commenced. Fish may be preserved for a short time by smoking only, but it could not be kept permanently. Hams and larger sausages require a longer period of smoking than do similar smaller articles of diet.

THE MAHOGANY TRADE OF HONDURAS.¹

THE Republic of Honduras, as well as the territory known as British Honduras, have long been celebrated for their forests of mahogany and other fine-grained woods. Belize, the capital of the British possessions in Central America, now a city of considerable commercial importance, owes, says the United States consul at Ruatan, its origin and wealth to the mahogany-cutters. During the first half of the present century, princely fortunes were quickly accumulated in the business; but, since iron and steel have taken the place of wood in the construction of vessels, the mahogany trade has decreased to a notable extent, although it is still large and profitable. The mahogany cuttings of British Honduras require at present more capital to carry them on than formerly. The expense and difficulty of getting out the wood has greatly increased, as but comparatively few trees can now be found near to the banks of rivers and streams of sufficient depth of water to float the logs to the coast. In Spanish Honduras, and especially within the limits of the consular district of Ruatan, there are still forests abounding in mahogany and other precious woods, where foreign industry and capital might be safely and profitably employed.

The following is the system employed in manipulating the mahogany and in felling the trees, and in hewing, hauling, rafting, and embarking the logs in Honduras. Having selected and secured a suitable locality, and arranged with one of the exporting-houses of Belize to advance the means in provisions and money to carry on the works, the mahogany-cutter hires his gang of laborers for the season. Nearly all labor contracts are made during the Christmas holidays, as the gangs from the mahogany-works all congregate in Belize at that period. The men are hired for a year, at wages varying from twelve to twenty dollars a month. They generally receive six months' wages in advance, one-half of which is paid in goods from the house which furnishes the capital. The cash received by the laborers is mostly wasted in dissipation before they leave the city. Early in January the works are commenced. Camps, or "banks" as they are called, are organized at convenient places on the margin of some river in the district to be worked. Temporary houses, thatched with palm-leaves, are erected for the laborers, and a substantial building for the store and dwelling of the overseer. The workmen are divided into gangs, and a captain appointed over each gang, whose principal duty is to give each man his daily task, and see that the same is properly done.

All work in mahogany-cutting is done by tasks. The best laborers are out at daybreak, and generally finish their task before eleven o'clock. The rest of the day can be spent in fishing, hunting, collecting India-rubber and sarsaparilla, or in working up mahogany into dories, paddles, bowls, etc., for all of which a ready market is found. The mahogany-tree hunter is the best paid and the most important laborer in the service. Upon

¹ From the Journal of the Society of Arts, London.

his skill and activity largely depends the success of the season. Mahogany-trees do not grow in clumps and clusters, but are scattered promiscuously through the forests, and hidden in a dense growth of underbrush, vines, and creepers. It requires a skilful and experienced woodsman to find them. No one can make any progress in a tropical forest without the aid of a *macheté*, or heavy bush-knife. He has to cut his way step by step. The mahogany is one of the largest and tallest of trees. The hunter seeks the highest ground, climbs to the top of the highest tree, and surveys the surrounding country. His practised eye detects the mahogany by its peculiar foliage. He counts the trees within the scope of his vision, notes directions and distances, then descends and cuts a narrow trail to each tree, which he carefully marks, especially if there is a rival hunter in the vicinity. The axe-men follow the hunter, and after them go the sawyers and hewers.

To fell a mahogany-tree is one day's task for two men. On account of the wide spurs which project from the trunk at its base, scaffolds have to be erected and the tree cut off above the spurs, which leaves a stump from ten to fifteen feet high. While the work of felling and hewing is in progress, other gangs are employed in making roads and bridges, over which the logs are to be hauled to the river. One wide truck pass, as it is called, is made through the centre of the district occupied by the works, and branch roads are opened from the main avenue to each tree.

The trucks employed are clumsy and antiquated contrivances. The wheels are of solid wood, made by sawing off the end of a log and fitting iron boxes in the centre. The oxen which draw these trucks are fed on the leaves and twigs of the bread nut tree, which gives them more strength and power of endurance than any other obtainable food. Mahogany-trees give each from two to five logs ten to eighteen feet long, and from twenty to forty-four inches in diameter after being hewed. The trucking is done in the dry season, and the logs collected on the bank of the river, and made ready for the floods, which occur on the largest rivers in June and July, and on all in October and November. The logs are turned adrift loose, and caught by booms. Indians and Caribs follow the logs down the river to release those which are caught by fallen trees or other obstacles in the river.

The manufacturing process consists in sawing off the log-ends which have been bruised and splintered by rocks in the transit down the river, and in re-lining and re-hewing the logs by skilful workmen, who give them a smooth and even surface. The logs are then measured, rolled back into the water at the mouth of the river, and made into rafts to be taken to the vessel, which is anchored outside the bar. The building of sloops and small schooners for the coasting trade is an important industry in the island. The frames of such vessels are made of mahogany, Santa Maria, and other native woods of well-tested durability, and proof against the ravages of worms, which abound in the waters.

At present the only woods exported from Honduras are mahogany and cedar wood, although the forests abound in other varieties, which Consul Burchard states are quite as useful and ornamental, and which must eventually become known in foreign markets, and open "new and inviting fields for industry and trade."

CANADIAN SOCIETY OF CIVIL ENGINEERS.

THE fifth annual meeting of the Canadian Society of Civil Engineers was held in Montreal on Jan. 15, when Col. Sir Casimir Gzowski, A.D.C., was re-elected president for the third time. In consequence of ill health he was unable to deliver the usual set address, but in a short speech he congratulated the society upon the continued and steady progress which it was making, stating that it already occupied a position which its sister society in the United States had not reached in the first decade of its existence.

The total number on the list now includes 633 members, associates, and students, and many original papers of engineering value have already been printed. It was also announced that the president had endowed a silver medal to be awarded annually for the best paper submitted during the year, provided such paper shall be adjudged of sufficient merit as a contribution to the literature of the profession of civil engineering. The first of these

medals has been awarded to Mr. E. Vautelet for his paper on "Bridge Strains."

During the past year the society has moved from the rooms generously lent by the University of McGill College to more commodious quarters specially fitted up for their accommodation, and centrally located on St. Catherines Street, near the Windsor Hotel.

The principal papers discussed by the society during the past year are the following: "The Screening of Soft Coal," by J. S. McLennan; "The Manufacture of Natural Cement," by M. J. Butler; "Columns," by C. F. Findlay; "Irrigation in British Columbia," by E. Mohun; "The Sault Ste. Marie Bridge," by G. H. Massy; "Generation and Distribution of Electricity for Light and Power," by A. J. Lawson; "Developments in Telegraphy," by D. H. Keeley; "Errors of Levels and Levelling," Parts 1 and 2, by Professor C. H. McLeod.

LETTERS TO THE EDITOR.

*** Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

The editor will be glad to publish any queries consonant with the character of the journal.

On request, twenty copies of the number containing his communication will be furnished free to any correspondent.

Rain Formation.

It will probably be readily admitted that one of the most complex problems in meteorology is the explanation of the condensation of vapor into visible drops. Cloud has been formed in a receiver by cooling saturated air very rapidly, but it is doubtful whether actual raindrops have been formed artificially. One of the most serious difficulties encountered in studying the problem has been the fact that our observations have been made mostly several thousand feet below the point of formation of the rain-drop. Observations on mountain tops have shown a great increase in precipitation above that at the base; for example, the rainfall on Mount Washington (6,279 feet) is double that at Portland, Me., though the latter station is on the seacoast. In September, 1880, the precipitation was 15.23 inches and 3.20 inches, and for the year ending June 30, 1880, 97.10 inches and 45.02 inches, at the two stations respectively. An explanation of this apparent anomaly might aid in solving the general problem before us.

It has been held by some that the rocks and earth at the top of the mountain are colder than the air which blows over it, and for this reason there is the greater condensation at the summit; but it has been proved that the rocks on Mount Washington are several degrees warmer than the air, so that this explanation will not hold. Others have thought that warm saturated air, as it is forced up the side of the mountain, is very much cooled by expansion, and this cooling produces the increased precipitation. This does not hold, however, in the case of Mount Washington, because the top rises up like a sharp cone, and the increased rainfall covers an area many times greater than can possibly be affected in this way. I think it will be admitted that a large share of the precipitation on our mountains is formed within a few hundred feet of the top, in a vertical direction. If so, it would seem that we have here a most excellent opportunity for studying this problem.

There have been published recently, by Harvard College, a complete set of the observations made by the Signal Office at Pike's Peak (14,134 feet), from 1874 to June, 1888, and these are now in a most convenient form for study. It has occurred to me that a valuable addition to our knowledge of the conditions under which precipitation occurs might be made by studying the connection, if any existed, between the temperature fluctuations and precipitation at this elevated point. The usual view is, that a column of saturated air in which moisture is forming into drops or snow-flakes is warmer than the air all about at the same level, and for this reason it has a tendency upward. We may put this in another form: if we pass into a column of air in which rain is falling, we shall find the temperature steadily increasing from the circumference to the centre; or, if we take the second interpretation just given for the increased rainfall at the summit of a

mountain, a warm saturated air is continually rushing up the side of the mountain, and the temperature must necessarily rise as long as the rain is formed.

I have projected in curves all the temperature observations at Pike's Peak for the hundred and thirty-six months during which at least .75 of an inch of rain fell. There were thirty-eight months, in all, in each of which less than that amount fell. A very slight diurnal range was eliminated in the manner already indicated many times. Then the precipitation for each eight hours was placed upon the curve of temperature, and the condition of the temperature and precipitation was taken out under three heads,—first with rising, second with stationary, third with falling, temperature. The results for each month are given in the following table:—

Pike's Peak Precipitation and Temperature.

	TEMPERATURE.					
	Rising.		Stationary.		Falling.	
	Total Inches.	Per Cent.	Total Inches.	Per Cent.	Total Inches.	Per Cent.
January.....	3.38	16	4.05	20	13.40	64
February.....	3.22	17	4.92	27	10.27	56
March.....	5.24	17	6.17	20	19.31	63
April.....	13.84	25	16.17	29	26.13	46
May.....	14.68	27	20.11	37	19.98	36
June.....	7.11	27	6.53	25	12.66	48
July.....	17.48	28	16.05	26	28.49	46
August.....	10.38	19	15.32	28	29.19	53
September.....	4.48	20	5.37	24	12.69	56
October.....	4.41	24	4.63	26	9.09	50
November.....	4.29	17	6.88	27	14.34	56
December.....	3.09	17	3.11	17	12.26	66
Year.....	91.60	22	109.31	27	207.81	51

No one can be more surprised than the present writer at this extraordinary result, so contrary to all preconceived theories. We find that on the average more than half the rain occurs with a falling temperature. It seems probable, however, that in general the rain is independent of the temperature. While it might be thought that a falling temperature in a saturated air would tend to produce precipitation, yet such is by no means the fact. There are many cases in which a fall of from ten to fifteen degrees Fahrenheit has occurred in a saturated air without any corresponding rainfall. Whatever may be thought of these facts, there is one point that is certainly made perfectly clear in this discussion, and that is that the temperature in a column of air in which rain is falling is not *higher* than that of the surrounding region.

It is probable that some will think there is a contradiction between the results here presented and those given several times before, especially in this journal for Sept. 5, 1890, but I think this is only a seeming contradiction. While the great bulk of the rain in the eastern part of the country occurs with a rising temperature at the earth's surface, yet I have shown, that, during the passage of storms and high areas, the temperature in the upper air changes several hours earlier than at the earth (in the case of Mount Washington five to ten hours earlier); so that there may easily be a falling temperature where the rain is formed. Several months of observations at Mount Washington have shown practically the same result as at Pike's Peak.

For several years I have contended that there is absolutely no proof of an ascending current in the centre of our storms, or even where rain is falling. It seems as though the present discussion must be regarded as a culminating point, and a perfectly satisfactory disproof of such ascending current.

H. A. HAZEN.

Washington, Jan. 26.

BOOK-REVIEWS.

Socialism New and Old. By WILLIAM GRAHAM. (International Scientific Series.) New York, Appleton. 12°.

THIS is an interesting work. It is written in a more attractive style than that of most economic treatises, and bears the marks of study and thought as well as of a philanthropic spirit. It opens with a statement of what socialism is, its various forms being recognized and defined, with special attention to what is now the leading form of it, that known as collectivism, or nationalism, according to which the State is to be the owner of all the instruments of production, while private property in other things is to remain undisturbed. The author then sketches the history of socialism with special reference to the evolution of the contemporary forms of it, and showing the various contributions of Rousseau, St. Simon, Marx, and others to the doctrine as it is to-day. He then goes into an elaborate discussion and criticism of the proposed socialistic or collectivist state, pointing out the respects in which it would be sure to fail, as well as others in which its success would be very doubtful. The main objection he makes, and one that he rightly deems insurmountable, is the impossibility of determining the relative rates of wages of the different classes of workers in the socialistic state. He has no difficulty in showing that equality of payment would be impracticable, since the more skilful workmen and the abler managers could not be induced to put forth their best efforts except for relatively higher pay; while, on the other hand, there is no possible way to determine how much higher the pay ought in justice to be. Other objections, such as the impossibility of applying the collectivist scheme to foreign trade, the lack of personal liberty under a socialistic regime, and the difficulty of providing for intellectual workers, are also emphasized; and the conclusion is that the attempt to introduce the system "would bring chaos, and 'confusion worse confounded,' until human nature rose in revolt against the impossible thing."

But while Mr. Graham is no collectivist, he maintains that the condition of the laboring classes can be bettered, and ought to be bettered, and that the State ought to do it; yet he seems at a loss with regard to the means. He has some chapters on "practicable socialism," in which he advocates several measures of a more or less socialistic character, such as State loans to co-operative societies, allotments of land to laborers, and purchase of city lands by the municipalities, all more or less objectionable, and, as it seems to us, promising but little real benefit to the poor. Mr. Graham, in short, is more successful as a critic of socialism than as a constructive social reformer; the most useful suggestion he makes being that of giving all classes the means of getting a good education in order to equalize opportunities,—a suggestion, however that is not new. In his last chapter he discusses the supposed present tendency toward socialism, expressing the opinion that such tendency is overrated, and that counter tendencies are at work which will nullify the socialistic movement. Altogether, Mr. Graham has given us a useful discussion, and one that deserves to be read by all who are interested in the subject.

AMONG THE PUBLISHERS.

HENRY HOLT & Co. have just ready "Told After Supper," a series of brief burlesque ghost-stories by Jerome K. Jerome. Although represented as told in good faith by their narrators, the reader is sometimes let into a hint of realistic explanation which gives the touch of good-natured satire characteristic of the author.

—Benjamin R. Tucker, Boston, has just ready "Church and State," a new volume of essays on social problems, by Count Leo Tolstoi, translated directly from Tolstoi's manuscript. It was written several years ago, but has thus far been kept in manuscript.

—Roberts Brothers will publish Feb. 10 the following: "Petrarch, his Life and Works," by May Alden Ward (author of a similar work on Dante), a clear and well-written sketch, in which the subject is considered as the precursor of the Renaissance, and as one of the great triumvirate that created the Italian language and inaugurated its literature; and a volume entitled "Power through

Repose," by Annie Payson Call, who treats of such subjects as training for rest, rest in sleep, the body's guidance, training of the mind, etc.

— Macmillan & Co. announce an edition of Lock's well-known "Arithmetic," revised and adapted for the use of American schools by Professor C. A. Scott of Bryn Mawr College, Pennsylvania.

— The Stefanite aluminum process aims at introducing aluminum into iron, either in the blast-furnace, the cupola, or the puddling-furnace. During the process of manufacture, the liberation of the aluminum from its ores goes on concurrently with the manufacture or melting of the iron, the newly formed metal being instantly alloyed with the iron. It is well known that a minute percentage of aluminum has the effect of lowering the melting-point of iron and steel, rendering it extremely fluid, so that it can be run with great facility without blow-holes. The cost of the process has hitherto rendered its adoption very slow, in spite of the great economies which have been effected by the various electric and electrolytic processes for the production of aluminum. It is with the intention of reducing this cost that the Stefanite process is being introduced. It is not in actual operation in this country, the trials which have already been made having been conducted in Germany. As communicated to *Engineering*, the method of operation consists in the addition to the iron ore in the blast-furnace, or to the pig in the cupola, of emery and alum, either in powder or made up into briquettes. It is stated that the re-action of the alum on the emery gives rise to vapors of metallic aluminum, which instantly alloy themselves with the iron, imparting to it the improved qualities which have hitherto been gained by the addition of aluminum or ferro-aluminum in the ladle or the crucible. The subsequent blowing does not volatilize the aluminum which descends with the iron. When the materials are added in the puddling-furnace, the bars, we are informed, can be hardened and tem-

pered like steel, while their tensile strength is increased. The invention is in the hands of Mr. Thompson Freeman, of 2 Victoria Mansions, Westminster, London, England.

— "Nature's Wonder Workers" is the title of some short life-histories in the insect world, by Kate R. Lovell, which the Cassell Publishing Company have ready. In this book the author's aim is to interest the reader in what are called the "useless insects."

— "Supposed Tendencies to Socialism" is the title of the article that will open the March *Popular Science Monthly*. It is by Professor William Graham of Belfast, who gives his reasons for expecting a progressive improvement in the state of society, but no sudden social transformation. "Iron-Working with Machine-Tools" will be the special topic of an article in the American Industries Series. This division of the series is to conclude with an account of the steel-manufacture. In the tariff discussions of recent years, sisal has been one of the articles most frequently mentioned. How it is produced and what it looks like may be learned from the illustrated article on "Cultivation of Sisal in the Bahamas," by Dr. John I. Northrop. One of several articles announced for the same number of the *Popular Science Monthly* is an explanation of Dr. Koch's method of treating consumption, by Dr. G. A. Heron, a London physician, and a friend of the discoverer. An explanation of the real nature of Voodoo, traces of which are found among the negroes in our Southern States, with a description of the strange and wild ceremonies connected with it, will also appear in this number. The writer, Hon. Major A. B. Ellis, is an officer in the British Army.

— "Bibliotheca Polytechnica," a directory of technical literature, is a classified catalogue of all books, annuals, and journals published in America, England, France, and Germany, including their relation to legislation, hygiene, and daily life. It is edited by Fritz von Szczepanski. The first annual issue of this new international index to the progress of technical science has appeared

Publications received at Editor's Office,
Jan. 19-31.

- BARDEEN, C. W. Effect of the College Preparatory High School upon Attendance and Scholarship in the Lower Grades. Syracuse, N. Y., Bardeen. 5 p. 8°.
- BIENBAUM, Max, Prof. Koch's Method to cure Tuberculosis popularly treated by. Tr. by Dr. Fr. Brendecke. Milwaukee, Wis., H. A. Haferkorn. 106 p. 12°.
- BROOKLYN Daily Eagle Almanac, 1891. Brooklyn, Daily Eagle Pr. 296 p. 8°. 25 cents.
- GRAHAM, W. Socialism New and Old. New York, Appleton. 416 p. 12°.
- HARRIS, W. T. Hegel's Logic. Chicago, Griggs. 403 p. 16°. \$1.50.
- HEWITT, W. Elementary Science Lessons. Standard I. London and New York, Longmans, Green, & Co. 115 p. 16°. 50 cents.
- HEYDENFELDT, S., Jr. The Union of the Conscious Force. New York, J. J. Little, Jr. 105 p. 8°.
- HOOGWERFF, J. A. Magnetic Observations at the United States Naval Observatory, 1888 and 1889. Washington, Government. 100 p. 4°.
- INGERSOLL, R. G. Liberty in Literature. Testimonial to Walt Whitman. New York, Truth Seeker Co. 77 p. 12°. 50 cents.
- LEFFMANN, H., and BEAM, W. Examination of Water for Sanitary and Technical Purposes. 2d ed. Philadelphia, Blakiston. 130 p. 12°.
- LODGE, G., ed. Plato Gorgias. Boston, Ginn. 308 p. 12°. \$1.75.
- MARINE Biological Laboratory of Wood's Holl, Biological Lectures delivered at the, in the Summer Session of 1890. Boston, Ginn. 250 p. 12°.
- MAXWELL, W. H. Examinations as Tests for Promotion. Syracuse, N. Y., Bardeen. 11 p. 8°.
- MICHIGAN, Laws of the State of, relating to the Public Health, in Force in the Year 1890. Lansing, State. 173 p. 8°.
- MISSOURI, Biennial Message of Gov. David R. Francis to the Thirty-sixth General Assembly of the State of. Jefferson City, State. 42 p. 8°.
- NEW YORK Institution for the Blind, Fifty-fifth Annual Report of the Managers of the, for the Year ending Sept. 30, 1890. Albany, State. 77 p. 8°.
- PENNSYLVANIA Oral School for the Deaf, Scranton, Fifth Report of the, for the Years 1888-89, 1889-90. Scranton, F. F. Schoen, Jr. 27 p. 8°.
- ROSE, G. H. Text-Book of Hygiene. 2d ed. Philadelphia and London, F. A. Davis. 421 p. 8°. \$2.50.
- SABIN, H. Organization and System vs. Originality and Individuality on the Part of Teacher and Pupil. Syracuse, N. Y., Bardeen. 9 p. 8°.
- SCRIBNER'S MAGAZINE, Comics from. New York, Scribner. 8°. 10 cents.
- SOLDAN, F. L. Tiedemann's Record of Infant-Life. Syracuse, N. Y., Bardeen. 46 p. 16°.

- TERRY, J. Sculptured Anthropoid Ape Heads. New York, Amer. Mus. Nat. Hist. 15 p. 4°.
- THOMPSON, S. P. Lectures on the Electromagnet. New York, W. J. Johnston Co. 287 p. 12°.
- U. S. GEOLOGICAL SURVEY. Topographical Map of the United States. Washington, Government. 9 sheets. 1°.
- Topographical Maps of Portions of New Jersey, Pennsylvania, Delaware, Maine, New Hampshire, Wisconsin. Washington, Government. 12 maps. 1°.

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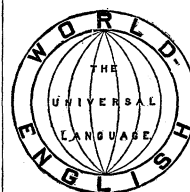
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—We learn from the *Journal of Economics* that a new serial publication devoted to economic discussion is about to appear in England as the organ of the newly founded British Economic Association. The association was organized in November last, with Mr. Goschen as president, and other men of eminence in the economic world in the other offices. The aim of the association is to promote economic study and discussion by all the means usually employed by such societies, but more particularly through the medium of the new journal, the first number of which will appear in March. It will not be the mouthpiece of any one school, but will welcome contributions from any writer who is master of his subject. In view of the prominence of English writers in the development of economic science, it is a little strange that such a movement has not been made by them before; but, now that it has been started, it can hardly fail to be important. There is also to be another periodical issued in England, called the *Economic Review*, which will deal with economic subjects in their moral and social aspects, and which will number among its contributors both English and American writers. The appearance of the new journals will be awaited with interest.

—In October last appeared the first number of the *International Journal of Ethics*, published in Philadelphia and London, and edited by a committee consisting of Americans,

Englishmen, and Germans. It is the successor of the *Ethical Record*, which was an organ of the ethical societies; but the new magazine is of a broader character, and devoted to the discussion of all ethical subjects, both theoretical and practical, without being an organ of any movement or opinion whatever. The first number was of a high order, the papers by Messrs. Sidgwick, Adler, and Höffding being especially suggestive, and the whole magazine giving excellent promise for the future. The January issue, however, is not so good, and contains some of those superficial and half-digested essays which are nowadays all too common. It opens with a well-considered article by Professor D. G. Ritchie, on "The Rights of Minorities," in which the writer maintains that the essential right of minorities is that of freely inculcating their views so as to persuade other people to adopt them, thus converting the minority into a majority. Next follows a review of Professor James's "Psychology," by Josiah Royce; an article on "The Inner Life in Relation to Morality," by J. H. Muirhead; and others on "Moral Theory and Practice," by John Dewey, and on "Morals in History," by Fr. Jodl; but none of these can be said to carry much weight. "The Ethics of Doubt," by W. L. Sheldon, is a thoughtful paper on Cardinal Newman, and some of the lessons of his life and career. Mr. F. H. Giddings has a brief article on "The Ethics of Socialism," and there is an interesting account by Mrs. M. McCallum of the ethical societies of Great Britain. On the whole, there is promise of much good in the new journal; but its conductors must maintain a high standard, and require thorough workmanship on the part of their contributors, if it is to hold the place that it ought to hold in the periodical literature of the time. The journal is published at 1602 Chestnut Street, Philadelphia, at two dollars a year.

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CONTENTS OF JANUARY NUMBER:

To Our Readers.
Presidential Address
Steps in our Knowledge of the Organic World.
The Mountain Sphinx.
Appendicularia, with its "Haus," Illustrated.
Koch's Remedy for Tuberculosis.
Aspect of the Heavens—January.
Half-an-Hour at the Microscope, with Mr. Tuffen West.
Foraminifera from Atlantic Soundings.
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